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Does the Market Self-Correct? Asymmetrical Adjustment and the Structure of Economic Error

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ABSTRACT *While both errors of overoptimism and errors of overpessimism are possible in the face of imperfect information, the presence of option value from deferring a decision to exchange causes trader errors to be overpessimistically biased. This is problematic because, unlike errors of overoptimism, errors of overpessimism are not 'automatically' revealed to the agents who make them. Furthermore, owing to the 'bad news principle of irreversible investment,' these errors are likely to persist. We show how entrepreneurial activity corrects such errors and prevents their persistence, creating a tendency towards market efficiency despite the presence of imperfect information.*

1. Introduction

Given its considerable importance for understanding economic processes and the behavior of market economies, the subject of agent error in economic decision-making has received relatively little attention. The textbook story of producer error correction is a simple and familiar one. If the producer establishes a price for his product higher than the equilibrium price, the resulting surplus requires him to lower his price in order rid himself of undesired inventory. This lower price has the dual effect of reducing quantity supplied and increasing quantity demanded, bringing the market into equilibrium. If, on the other hand, the producer sets his price too low, the bidding activities of demanding consumers drive the price up, ensuring that no shortage results. The increase in price achieves equilibrium as the quantity supplied rises and the quantity demanded falls. The market is thus self-correcting in the face of 'both sides' of pricing error.

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While this oft-repeated story clearly conveys the process of price equilibration, it leaves much to be explained regarding the question of how traders 'get things right' on the market. In a world characterized by uncertainty, agents have only imperfect information on the basis of which they must form expectations about the profitability of potential exchanges. Their expectations are therefore imperfect as well. To the extent that individuals are able to perfectly assess the profitability of exchanges, the mutually beneficial gains from exchange are exhausted. To the extent that agents imperfectly forecast the profitability of exchanges, however, gains from trade may go unrealized.

Agent errors come in two forms: *errors of overoptimism* and *errors of overpessimism*. While both types of error are possible, the presence of option value from deferring a decision to exchange causes trader errors to be overpessimistically biased. By their nature, errors of overoptimism are 'automatically' revealed to the erring agent who learns his mistake and corrects it in the future, bringing the arena of exchange back into equilibrium. The overoptimistic side of the market may be said to be self-correcting in much the fashion described in our price story above.[1]

For errors of overpessimism, on the other hand, there does not appear to be an 'automatic' revelation process so agents committing this sort of mistake may not learn that they have done so. Indeed, as Bernanke's 'bad news principle of irreversible investment' suggests, errors of overpessimism are likely to be persistent. The magnitude of this problem is potentially significant as the majority of mistakes made on the market are of this uncorrected type—errors of overpessimism.

Agent errors pose no particular problem so long as they are reliably corrected without undue delay. Do we have good reason to expect this to be the case? While the literature has achieved consensus regarding the trivial proposition that 'no point with systematic arbitrage opportunities can be an equilibrium,' as Franklin Fisher (1981, p. 279) has pointed out, 'what is required is a demonstration that arbitrage actually leads to [positions with no unexploited arbitrage opportunities]—and does so quickly.' In an effort towards this end, Fisher's insightful work on stability contends that 'new, previously unforeseen opportunities' keep the market in disequilibrium. How then are these errors corrected, if at all?

It is our contention that the market has a mechanism whereby errors of overpessimism are corrected. The entrepreneur, in seeking and exploiting hitherto unknown profit opportunities, continually corrects these errors that would

[1]Instability problems may cause errors of overoptimism that lead to a bubble. These errors will eventually be corrected, but in this case correction may entail real consequences on the pattern of exchange and production in an economy. In this instance, we agree with the Austrian view that the classical dichotomy can be violated due to distortions in the credit market—that changes in nominal variables can have real effects in the economy. Credit manipulation causes economic actors to be overly optimistic in their decisions (e.g. causes them to see profit opportunities where they didn't see them before) and thus to invest in projects that appear to be profitable but are not, given the underlying realities of tastes, technology and resource availability. The 'cluster of errors' that businessmen were led to make because of the manipulation of money and credit are revealed through time; the ensuing correction of the errors constitutes the bust phase of the business cycle.

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Table 1. Approaches to Economic Analysis

		Problem situation	
		Simple	Complex
Market outcome	Order	Neoclassical	Austrian
	Disorder	Marxism	Post Keynesian

otherwise persist, creating inefficient markets.[2] Our analysis therefore establishes a tendency towards market efficiency despite the presence of imperfect information and a complex problem situation.[3]

Our argument occupies a unique place in political economic discussions, particularly those that approach such questions from a heterodox perspective. Economic analyses can be broken into four conceptual categories—each describing (1) a particular problem situation for economic actors and (2) the market's ability to handle these situations. These categories are depicted in Table 1.

The first category is occupied by standard neoclassical economics. In assuming perfect information, neoclassical economics considers 'simple' problem situations. It addresses how perfectly informed individuals act to maximize profits or minimize costs given certain cost constraints on their behavior. Neoclassical economics traditionally demonstrates the ability of markets to overcome simple problem situations and achieve static optima. Its great achievement is that it has provided a rigorous demonstration that under these rarified conditions resource allocation will be Pareto optimal.

Like neoclassical economics, Marxist political economy can be said to pose a simple problem situation for individuals. Unlike neoclassicists, however, Marxist economists contend that the market economy does not generate social harmony.[4] Marxist theory, from the point of view of equilibrium theorizing, still raises the problems of monopoly and business cycles that are within this framework endemic to capitalism.

[2]In their important work, Fernandez & Rodrik (1991) argue that given uncertainty regarding the distribution of gains and losses of government policy, agents may be overpessimistic regarding policy changes. The resulting bias towards the status quo means that efficiency-enhancing policies fail to be adopted. Our analysis can be viewed as constructing an analogous argument for markets. However, unlike the political sphere, which has no mechanism of overpessimistic error-correction, we demonstrate that the mechanism of the entrepreneur operates to correct and prevent inefficiencies owing to overpessimistic bias in the market.

[3]We define a complex problem situation as one where time is irreversible, the structure of production consists of heterogeneous goods with multiple specific uses, and there is an uncertain future demand toward which production activities must be directed.

[4]We realize that our characterization of Marxism may be controversial, and that instead one could see Marx as the quintessential theorist who worked inside a complex problem situation of a social and historical perspective. However, as John Roemer (1982) has sought to demonstrate, a Marxist economist can work inside of the Walrasian system and still generate proofs of exploitation and surplus value.

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In contrast to these two approaches, Post Keynesian economics considers economic actors who confront 'complex' problem situations. Issues of imperfect information and uncertainty move to the forefront of such analyses and richer more complicated obstacles become the focus. Post Keynesian approaches have demonstrated the market's inability to perform effectively when confronted with such problem situations and in this sense share with the Marxist approach a belief that markets are prone to inefficient outcomes. The non-ergodic nature of economic reality defies the ergodic theories of neoclassical equilibrium and thus produces outcomes wildly different from what standard economic models would predict. Policy advice based on models that assume an ergodic world is inapplicable and socially dangerous when applied to understanding and controlling the non-ergodic market system.

Our argument occupies a fourth distinct category in economic discussions. Like Post Keynesians, we aim to analyze a complex problem situation—one that starts with the fact that individuals operate in an uncertain world and are only imperfectly informed. Unlike Post Keynesian analyses, however, we argue that the market economy exhibits a great degree of robustness in dealing with such obstacles. Our approach is an Austrian one, though it is distinctive within heterodox discussions in that it demonstrates market effectiveness in the face of complex problems.[5]

The remainder of this paper proceeds as follows. Sections 2, 3 and 4 provide a theoretical rendering of the problem of markets' bias toward overpessimism. Section 5 provides a discussion of the entrepreneur and his role in correcting these errors.

2. Ideal Conditions and Exchange Equilibrium

We can conceive of traders as lying somewhere along a spectrum of optimism/pessimism with regard to exchange opportunities. This level of optimism/pessimism relates to their beliefs about the profitability of a potential exchange, which is a function of the completeness of their information about the conditions concerning that exchange (e.g. market conditions or the credibility of their exchange partner). Under ideal conditions, in which individuals have perfect information about the circumstances surrounding potential exchanges, traders deciding over exchange will have the 'right amount' of optimism/pessimism. This level of pessimism is consistent with the exhaustion of all desirable exchange opportunities. At this level of pessimism, no traders who commit to exchanges incur losses and no traders who could have exchanged without incurring losses do not exchange.

[5]The work of Austrian authors Ludwig Lachmann (1986) and G.L.S. Shackle (1961) sits between the more standard Austrian and Post Keynesian approaches. Lachmann and Shackle strongly emphasized the 'radical uncertainty' that actors confront, but they tended to arrive at more Post Keynesian conclusions regarding the market's ability to deal with complex problems. We contend that in emphasizing what these authors called 'isolated minds', they failed to appreciate important institutional features of the market, for instance, entrepreneurship—that constitute a 'constellation of minds,' which we contend enables the market to overcome complex problems.

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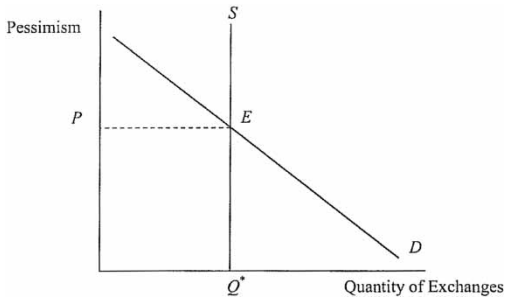

Figure 1. Market equilibrium under ideal conditions

This level of pessimism therefore constitutes the equilibrium level of pessimism, and the quantity of exchanges transacted at the equilibrium level of pessimism constitutes the equilibrium quantity of exchanges. The equilibrium quantity of exchanges under the ideal conditions described above is depicted in Figure 1.

On the abscissa is the level of pessimism and on the ordinate is the quantity of exchanges. The 'supply' of exchanges is given by the perfectly pessimism-inelastic curve *S*, which represents the given stock of exchanges available in the economy at any given time. The demand curve for exchanges, *D*, is negatively sloped as the quantity of exchanges demanded by potential traders increases as their pessimism decreases (or stated alternatively, as their optimism increases). P^* represents the equilibrium level of pessimism and Q^* represents the equilibrium quantity of exchanges transacted, where point *E* is the equilibrium point in the arena of exchange. This graph is important in understanding the consequences of trader error in the analysis that follows.

3. The Self-Correcting Side of the Market: Errors of Overoptimism

Relaxing the assumption that individuals have perfect information regarding the profitability of potential exchanges introduces the possibility of trader error. Errors of overoptimism involve incurring losses and result from mistakenly forecasting profit when in fact the exchange is unprofitable. In this sense, traders committing such an error are overly optimistic—their level of pessimism is below the equilibrium level at which all trades transacted avoid losses. At this lower-than-equilibrium level of pessimism 'too many' exchanges are conducted.

Fortunately, errors of overoptimism are not difficult to correct because they are 'automatically revealed' by their very nature. With some exceptions, it is not difficult for traders who mistakenly assess an exchange as profitable to determine that this was the case and revise their behavior for the future. Traders committing errors of overoptimism learn of their mistake by incurring losses in exchange. Thus, over time, such errors tend to be corrected as traders who undertake unprofitable exchanges adjust their level of pessimism upward, leading ultimately to a reduction in the level of exchange. Pessimism is therefore flexible upward. This process is depicted in Figure 2.

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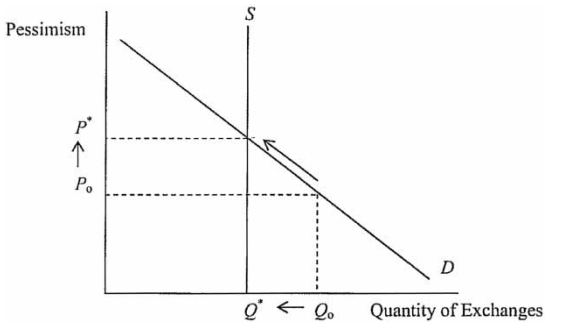

Figure 2. Overoptimistic disequilibrium and correction

At P_o, a level of pessimism below the equilibrium level P^*, the quantity of exchanges is too large by $Q_o - Q^*$. Because these errors are relatively easily detected, they are also relatively easily corrected. Thus, as the arrows in Figure 2 indicate, traders revise their level of pessimism upward from P_o to P^* shrinking the quantity of exchanges back to the equilibrium level Q^*. No permanent problem results.

4. The Non-Correcting Side of the Market: Errors of Overpessimism

4.1. Distributional Bias

Errors of overpessimism involve foregone profit opportunities resulting from a failure to exchange based on mistakenly assessing an opportunity to trade as unprofitable, when in fact the exchange is profitable. This section demonstrates why the distribution of trader errors will be biased towards errors of overpessimism. This asymmetry of trader errors is best understood in the context of option value (Weisbrod, 1964; Arrow & Fisher, 1974; Henry, 1974a, 1974b). Confronted with uncertainty generated by imperfect information about the conditions of exchange, traders must decide whether to commit to a present opportunity for exchange or defer such commitment to potential exchange at some future date.

Obviously, a trader cannot undo a past transaction if he does not like the outcome of his prior decision. Deferring commitment, in contrast, leaves open the option of exchanging his goods or money in the future. This future exchange could be entirely new—i.e. involve a different trading partner and different goods—or it could involve simply committing to the same exchange previously considered. With some exceptions, traders who defer in the present do not lose the chance to transact a similar exchange in the future by waiting. If you visit a car dealership today but decide not to buy right now because you are unsure about the honesty of the dealer, in most cases this decision to defer purchase does not eliminate the potential to purchase the identical (or very similar) car for the same (or similar) price at some point in the future.

The option value created by deferring exchange stems from the benefits of waiting to commit to a transaction. With the passing of time, better information

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about the profitability of the previously considered exchange becomes available as traders learn more about the relevant conditions surrounding the transaction. Returning to the example from above, deferring the purchase from the car dealer now gives you the opportunity to learn more about his reputation. Additionally, with the passing of time, information about the profitability of previously unconsidered potential exchanges may become available as well. For these reasons, option value is always positive.

Of course there is a cost to deferring a commitment to exchange as well—the expected value from presently committing to exchange. But in order for traders to commit to present exchanges, the expected value of a present exchange must not merely be greater than zero. Because option value is always positive, even significantly high rates of return from presently committing may be insufficient to generate present exchanges. For present exchange to occur, its expected value must be greater than the discounted expected value of the options foregone.

Because option value is largely a function of the benefit it confers upon traders in the form of their ability to avoid present mistakes by deferring commitment to the future, option value increases with uncertainty. Where agents have more information about the conditions of an exchange or are better at effectively forecasting profitability, uncertainty will be relatively lower and thus so will the option value that stems from deferring exchange. Conversely, where agents have less information about the conditions of an exchange or are worse at evaluating the profitability of potential trades, uncertainty will be relatively higher and thus so will the option value of waiting to commit.

Where option value is relatively higher, fewer present commitments to exchange will surpass the critical threshold. In short, presently committing to exchange is more costly. Because errors of overoptimism can only result from presently committing, errors of overoptimism are relatively more costly. The fact that errors of overoptimism are relatively more costly, of course, means that errors of overpessimism are relatively less costly. This cost discrepancy in turn implies that errors of overpessimism will be relatively more abundant than errors of overoptimism. That is, the distribution of trader errors will be biased towards errors of overpessimism.

From the trader's perspective, the problem thus appears this way: Confronted with imperfect information, our trader knows that he is likely to make some kind of mistake in assessing the profitability of potential exchanges. He could make either an error of overoptimism or an error of overpessimism. Owing to the existence of option value, errors of overoptimism tend to be more costly than errors of overpessimism. Since our trader knows that he will make one of these types of errors and the former are more costly, he finds it optimal to err on the side of overpessimism. Given the choice between an overly pessimistic mistake and an overly optimistic one, it is in our trader's interest to choose overpessimism, as this error appears on the face of it to hurt him the least.

As our trader recognizes, however, in erring on the side of overpessimism he is foregoing some profitable exchanges that he would transact were he able perfectly to evaluate the profitability of potential exchanges in the absence of uncertainty surrounding the conditions of trade. In other words, were it not for the fact that he has only imperfect information, our trader would choose less

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pessimism than he currently does. In this sense, his decision to refrain from exchanging with outsiders is overly pessimistic; and it is in this sense that we mean he has committed an 'error.'

Stated this way, it should be clear that the overpessimistic bias of traders confronted with imperfect information is entirely rational. Imperfect information does not cause actors to behave suboptimally given the choices that confront them. Rather, the optimal response of rational traders operating in this environment is precisely what leads to a lower rate of exchange than would have prevailed were it not for the fact that they have only imperfect information.

4.2. The Persistence of Overpessimistic Error

Above, we presented theoretical reasons to expect that the distribution of errors created by imperfect information will be asymmetrical. In the face of uncertainty, the majority of agent errors are likely to be errors of overpessimism. This section considers theoretical reasons for why these errors are also likely to persist, and in Section 5 we show how the entrepreneurial mechanism corrects this potential problem that would otherwise stand in the way of a tendency toward market efficiency. The 'bad news principle of irreversible investment' helps explain why we would expect overpessimistic errors to persist (Bernanke, 1983; Dixit, 1992). Because the option value of deferring commitment at present is zero where the expected value of present transactions exceeds the discounted value of the options foregone, traders deciding whether to defer commitment consider only the 'bad news' or 'losing' future states potentially resulting from committing at present. As we noted above, by deferring exchange now, traders gain better information and avoid potentially making mistakes in their judgment about the profitability of trades caused by committing to present exchange.

To the extent that the potential gains from undertaking a particular exchange will remain available over time, traders deciding over commitment or deferral will be primarily influenced by the potential losses they may incur by exchanging now. If the profit opportunities from exchange remain a viable alternative in future periods, traders will wait for better information to arrive and make decisions based on their expectations of incurring losses alone. In this sense, traders have a 'one-tailed decision rule'. Decisions regarding exchange with outsiders are primarily 'sensitive to downside uncertainty' (Bernanke, 1983). 'Upside potential' plays virtually no role. The existence of potentially 'winning' future states does not offset the existence of potentially 'losing' future states in traders' evaluations.

This analysis is important in explaining the theoretical persistence of errors of overpessimism for two reasons. First, it explains why errors of overpessimism are unlikely to be corrected. As we noted earlier, over time, errors of overoptimism are corrected as traders who earn losses adjust their level of exchange downward. However, traders who make errors of overpessimism have no such revelation process. They are not 'automatically' confronted with their mistakes, as are traders who make errors of overoptimism. To become aware of their error, overpessimistic traders must observe the 'success' of traders who did commit.

As the 'bad news principle of irreversible investment' showed us, however, any 'good news' overpessimistic traders might glean by observing others' success will have little impact on their decisions to commit. Because trader decisions

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about exchange are largely invariant to potentially winning future states, observing that other traders 'won' is essentially irrelevant. In short, traders committing errors of overpessimism do not learn from their mistakes in the way that traders committing errors of overoptimism do. Consequently, errors of overpessimism are likely to remain uncorrected.

Second, because exchange opportunities do not disappear with the passage of time, by deferring commitment now, traders preserve all (or most) of the upside of waiting longer without incurring any (or incurring very little) of the downside. This means that many overpessimistic traders faced with imperfect information stand to gain by continuing to wait to exchange. Overpessimistic traders thus have an incentive to remain overly pessimistic.

Both of these reasons imply that pessimism is rigid downward. Overpessimistic disequilibrium is depicted below in Figure 3.

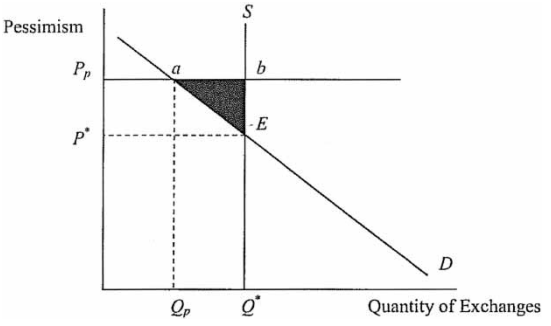

Figure 3. Persistent overpessimistic disequilibrium

At P_p, the level of pessimism is too high by $P_p - \hat{P}$, yielding the quantity of exchange Q_p that is too low by $Q^* - Q_p$. For the reasons indicated above, the disequilibrium level of pessimism, P_p, will not be adjusted downward as needed to bring the arena of exchange back into equilibrium. Instead, the level of pessimism will persist at P_p. As a result, a lasting deadweight loss given by the shaded triangle, *abE*, is generated leading to a lasting inefficiently low level of exchange, Q_p. In short, mutually beneficial exchanges are permanently going unrealized. The arena of exchange is trapped at an inefficiently low level of trade. The magnitude of this problem is heightened by the fact that the majority of trader errors are those that lead to this problem—errors of overpessimism.

An important note here regarding the applicability of rational expectations to our analysis is long overdue. The rational expectations hypothesis states that agent errors will be unbiased and will not persist over time, as rational agents learn from their mistakes and use this information to inform their future behavior. The foregoing analysis, however, gives us good reason to doubt the applicability of the rational expectations hypothesis. If errors of overpessimism are less costly than errors of overoptimism, then traders, on average, will not have the right level of pessimism. Rather, traders will, on average, be overly pessimistic regarding exchange. Furthermore, for the reasons pointed to above, agents cannot easily learn from mistakes of overpessimism to correct their expectations for future transactions.

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5. The Entrepreneur and the Correction of Errors of Overpessimism

As the above analysis suggests, in theory, the market seems to suffer from a persistent bias towards errors of overpessimism. We contend that this conclusion results from the fact that, to a large extent, standard accounts exclude entrepreneurship from their discussions of the market and therefore miss the critical role that entrepreneurial alertness to profit opportunities plays in correcting such errors. A consideration of the impact of entrepreneurial activity on errors of overpessimism indicates that such errors will tend to be corrected over time.

The entrepreneur has been characterized as an innovator (Schumpeter, 1950), an arbitrageur (Kirzner, 1973), one who bets on ideas (Brenner, 1985; Mokyr, 1990) and as a forecaster and capitalist (Rothbard, 1962). Each of these interconnected elements undoubtedly plays an important role in entrepreneurship. For the purposes of our analysis, however, we are most interested in the arbitrageur function of entrepreneurial activity.

In emphasizing this facet of entrepreneurship we should be explicit about the model of entrepreneurship we are using. Our discussion of the entrepreneur builds upon the model developed by Kirzner (1973). We believe that this approach is best suited to our purposes because of its focus on the arbitrage-capturing component of entrepreneurship. Kirzner's rendering of entrepreneurship also fits well with our analysis because he recognized the connection between entrepreneurship and errors of overoptimism and overpessimism (Kirzner, 1963; 1997, pp. 43–46).

Every economic action has an element of entrepreneurship to it. Economic decision-makers do not simply react to given data and allocate their scarce means to realize given ends. The entrepreneurial element in human action entails the discovery of new data and information, discovering anew not only the appropriate means, but also the ends that are to be pursued.

This understanding of entrepreneurship makes immediately obvious the fact that it is precisely the existence of trader errors that engenders the process of entrepreneurial adjustment and progress. In a world of certainty there would be no error and no role for entrepreneurial activity. The entrepreneur, in recognizing opportunities that others have not, coupled with his attempt to earn profits and avoid losses, drives the market process and the correction of errors. Today's inefficiencies represent tomorrow's profit opportunity for the entrepreneur who is able to realize gains from exchange that had previously gone unexploited.

This statement, of course, implies that different entrepreneurs view the profitability of the same potential exchange differently. Note that this does not conflict with the claim that all agents, when erring, tend to err on the side of overpessimism. Although all individuals are likely to disproportionately err on the side of overpessimism when they err, errors of overpessimism are not symmetric across all agents for any given potential exchange. In other words, overpessimism is *asymmetric*—one agent's error of overpessimism need not be the same as another's.

To see this, imagine two entrepreneurs, A and B, both of whom commit errors of overpessimism with the same probability where this probability is greater than 0.5. Thus, A and B disproportionately err on the side of overpessimism with equal likelihood. This fact does not, however, preclude A and B from having different

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degrees of optimism/pessimism for any given potential exchange. Thus, where A is overpessimistic about a certain exchange, B may see an opportunity for profit. As B acts to exploit the perceived profit opportunity, A's error of overpessimism is exposed and corrected. In the absence of entrepreneur B, the error would persist, creating a suboptimal situation in which gains from trade go unrealized. The entrepreneurial mechanism, however, tends to correct these errors as asymmetrically overpessimistic entrepreneurs serve as checks on one another. Although all agents are predisposed to make errors of overpessimism, different agents have different evaluations of the same exchange opportunities and it only takes one entrepreneur to correct an error.

Given this realization, we can compare and contrast the correction of errors of overoptimism with the correction of errors of overpessimisim. As discussed in Section 3, errors of overoptimism will be automatically revealed to actors through the profit and loss mechanism. Errors of overpessimism, in contrast, are not revealed automatically. Instead the correction of these errors requires alertness by other entrepreneurs who observe the potential for profit and exploit that opportunity. In other words, there will be a tendency for errors of overpessimism to be corrected over time. The correction of these errors is not as automatic and it is possible for these errors to last longer until an entrepreneur remedies the situation by exploiting the profit opportunity.

The speed of overpessimistic error correction will vary depending on a number of factors, including the thickness of the market and the institutional mix within which the entrepreneur must operate. Given constant uncertainty and new knowledge, there will always be errors to correct—the market will never reach equilibrium. However, the thicker the market is, the more entrepreneurs there are acting, and thus the quicker errors will be exposed and corrected. Likewise, an institutional environment that is conducive to entrepreneurial activities will lead to a faster adjustment process than one that stifles entrepreneurship.[6]

Considering the role of entrepreneurial activity in error correction also offers insight into the size of option value discussed in Section 4. In some cases, the activity of entrepreneurs may serve to shrink the option value related to postponing exchange until further information comes to light. Recall that option value is always positive because in many cases agents who defer in the present do not lose the chance to engage in a particular exchange in the future.

In light of asymmetric overpessimism, however, it should be realized that entrepreneurial activity can, in some cases, push the option value toward zero. The incentive for economic actors to postpone current exchange is weakened because other entrepreneurs who interpret the profitability of the exchange with greater clarity will take advantage of the opportunity. Since the exchange opportunity may not be available in the future, the option value of deferring in the present shrinks.[7]

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[6]For a thorough discussion of the institutional features conducive to entrepreneurial growth and inhibition see, Harper (2003).

[7]We acknowledge that that this beneficial aspect of entrepreneurial activity will not be present in every case. It will only be effective to the extent that such activity removes the possibility of gains from exchange for other traders in future periods.

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